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ABSTRACT

The purpose of this paper is to investigate the potential impact, on the distribution of labor income, of a policy that requires that in each firm minority workers: (1) receive the same wages as majority workers given the same job classifications and, (2) are employed in the same proportion as majority workers in all job classifications. This analysis is directed to the question of the maximum potential of affirmative action policies. Given that Affirmative Action Policies (AAP) have two principle provisions (equal pay for equal work, and mandatory hiring in each firm of minority workers to fill at least a specified fraction of skilled positions), the effects of the policy will depend on the size of the quota relative to the number of skilled minority workers in the economy, the degree to which the minority groups suffer labor market discrimination, and the nature of the way firms react to the new environment. Three different situations are explained: what happens when the quotas are set just equal to the supply of skilled workers, when quotas are set at less than the supply of skilled workers. In the remainder of the paper the implications of AAP for a number of special cases are investigated. For each case, a numerical model of income differences between the races is used. In the last section a model of heterogeneous labor is employed to investigate the potential impact of AAP on the incentives for minority and majority labor to acquire skills. (Author/AM)

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George E. Johnson Finis Welch

March 1976

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THE LABOR MARKET IMPLICATIONS OF AN ECONOMY-WIDE AFFIRMATIVE ACTION PROGRAM*

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THE LABOR MARKET IMPLICATIONS OF AN ECONOMY-WIDE AFFIRMATIVE ACTION PROGRAM

G. E. Johnson and F. Welch

I. Introduction and Summary

The purpose of this paper is to investigate the potential impact on the distribution of labor income of a policy that requires that in each firm in the economy minority workers (1) receive the same wage as majority workers given the same job classifications and (2) are employed in the same proportion as majority workers in all job classifications. This Affirmative Action Program (AAP) obviously exceeds the scope of current policies in this regard, for O.F.C.C. activities only apply to firms that do business with the federal government. Our analysis is thus directed to the question of the maximum potential impact of affirmative action policies.

The basic conceptual framework of the paper is based on an earlier paper by Welch[1] that investigated certain aspects of the problem within a two-sector framework. There are two categories of labor input and two identifiable social groups (sexes, races, or whatever) in the economy, and the proportion of the minority work force that is in the more skilled labor category is less than the minority/majority population ratio. It is assumed explicitly that labor market discrimination takes the form of a distaste by employers for hiring minority workers in skilled positions. This results in a lower wage for minority than majority skilled workers -- although we also consider the case in which there is no discrimination.

The imposition of AAP forces each firm to pay the same wage to skilled workers of both social groups and to hire at least a certain minimum of its skilled workers from the ranks of the minority group. This causes a redistribution and in some cases a reduction in labor income depending on the size of the quota and how firms are permitted to adjust to the policy.

In the remainder of the paper we investigate the implications of AAP for a number of special cases. For each case we employ a numerical model of income differences between blacks and whites in which the delineation of skill is college graduates versus other labor. In the final section a model of heterogeneous labor is employed to investigate the potential impact of AAP on the incentives for minority and majority labor to acquire skills. This approach points out the most serious problem with a policy of this sort: while a strictly enforced AAP would probably be effective in transferring income from majority to minority workers in the short run, it might have perverse implications concerning the distribution of skills of the two groups in the long run. Accordingly, alternative policies which are addressed directly to eliminating differences in the distribution of skills between the two groups would be more effective in the longer term.

The major points of the paper are as follows:

(a) Given that AAP has two principle provisions, (i) equal pay for equal work and (ii) mandatory hiring by each firm of minority workers to fill at least a specified fraction of skilled positions, the effects of the policy will depend on the size of the quota relative to the number of skilled minority workers in the economy, the degree to which the minority

group suffers labor market discrimination, and the nature of the way firms react to the new environment.

(b) If the quota is set just equal to the supply of skilled minority workers, AAP has no impact unless there is labor market discrimination. In this case, the program results in a transfer from skilled majority workers to skilled minority workers; other groups are unaffected.

(c) When the quota is set at less than the supply of skilled minority workers and there is labor market discrimination, there is an income transfer from all unskilled workers to majority skilled workers. The impact on minority skilled workers is ambiguous -- some gain slightly but others are forced to take unskilled jobs and lose. In the event that the labor market discrimination coefficient is zero, the policy has no effect in the aggregate.

(d) The most likely case is that where the quota is set at more than the available supply of skilled minority workers. Then, assuming that firms do not attempt to meet their quota by arbitrarily upgrading the job titles and pay of a subset of their unskilled minority workers, a number of skilled majority workers will be forced to leave their jobs and become unskilled workers. This situation obviously results in a "social cost" due to allocative inefficiencies. In addition, there is an income transfer from unskilled workers to skilled minority workers. Whether skilled majority workers gain or lose on average as a result of the policy is unclear; it depends on the elasticity of substitution between the two types of labor.

(e) In the preceding case there is a large group of majority workers with sufficient training to perform skilled jobs but who are unable to obtain them because of the quota system. It will then be profitable for some firms to hire them at a lower than prevailing skilled wage and meet

the quota by "bumping" some unskilled minority workers into the skilled job classification. This would create two classes of firms: those who meet the quota by hiring skilled minority workers and those who meet it by engaging in skill bumping. Since the average quality of labor paid as "skilled" in the latter firms is lower than for the former, the skilled wage in the former case will exceed that in the latter. Now all majority skilled labor is employed in a skilled capacity, so there are no allocative inefficiencies as in the preceding case. The policy results primarily in an income transfer from majority to minority skilled workers, but some minority workers also gain from the policy because they are paid the lower skilled wage rate.

(f) With skill bumping notice that there are two wage levels prevailing for skilled majority workers. If they can get away with it, firms which meet the quota by hiring skilled minority workers rather than engaging in skill bumping would prefer to pay a lower wage to their skilled majority workers, in fact that wage which prevails for the other class of firms. In this case, which we call "reverse wage discrimination," the degree to which skilled minority workers gain is increased, but, as before, there are no serious allocational inefficiencies.

(g) Finally, we attempt in the last section of the paper to generalize the model to the case of a continuous skill distribution. The major result of this approach is that the impact of the policy is greatest in the middle of the skill distribution -- minority workers gain most and majority workers lose most as a result of AAP when they are in the middle of the pack rather than at either of the extremes. The most interesting implication in this regard concerns the effect of the program on incentives

for skill acquisition. The rate of return to schooling for minorities will actually fall for high levels of schooling, and this would tend to exacerbate the problem of unequal skill distributions in the population. On the other hand, the increased incomes to minority workers might balance off this loss of incentive.

II. An Analytical Framework

A. Labor Market Equilibrium Prior to AAP

It is first useful to set out the nature of labor market equilibrium prior to the imposition of AAP. We will focus on a model in which there are two groups of workers, "skilled" and "unskilled." The production process is such that the former can perform the functions of the latter but not vice versa. The aggregate supply of skilled labor is fixed at $S = S_1 + S_2$, where the subscripts 1 and 2 refer to "majority" and "minority" workers, respectively. Similarly, the aggregate supply of unskilled labor is $U = U_1 + U_2$. The ratio of S_2 to S_1 is fixed at γ in the short run, and this is, for a variety of reasons, less than the minority/majority population ratio ρ.

The aggregate production function for the economy is $Q = F(S,U)$, and we assume that F_i is linear homogeneous. In the absence of labor market discrimination in the economy the two wage rates would equal their marginal products, or $W_s = \partial Q/\partial S = F_s$ and $W_u = \partial Q/\partial U = F_u$. There are numerous approaches to the specification of the nature of labor market discrimination, but we will assume the most rudimentary model of discrimination by employers.[2] That is, each firm in the economy perceives a psychic cost associated with the hiring of skilled minority workers and thus acts as if it is imposed with a tax of π on each S_2 worker it employs. The marginal cost (both monetary

and psychic) of hiring an S_2 worker is $W_s^2 + \pi$, but the marginal cost of hiring a skilled majority worker is only W_s^1. Thus, in order for marginal costs of skilled majority and minority workers to be equal, it must be true that $W_s^2 = W_s^1 - \pi$, where W_s^1 and W_s^2 are the wages of skilled majority and minority workers, respectively. We assume that employers do not care about the ethnicity, religion, sex, or whatever attribute of their unskilled workers, so both the U_1's and U_2's receive the single unskilled wage W_u.

The marginal products of the two grades of labor are, given the assumption of the linear homogeneity of F, both determined by the ratio of skilled to unskilled labor, $k = S/U$. In particular, $d(\log F_s)/d(\log k) = (1-\eta)/\sigma$ and $d(\log F_u)/d(\log k) = \eta/\sigma$, where η is the elasticity of output with respect to skilled labor and σ the elasticity of substitution between skilled and unskilled labor.[3] The total wage bill of skilled labor in the pre-AAP economy is $F_s S - \pi S_2$; employers have to be induced by the amount πS_2 to employ the S_2 skilled minority workers.

B. The Nature of the Affirmative Action Program

AAP has two components: (1) equal pay for equal work (i.e., W_s^2 must be made equal to W_s^1) and (2) each firm must employ at least q skilled minority workers for each skilled majority worker it employs. The quota is obviously a crucial part of AAP, for, since firms can no longer engage in direct wage discrimination, they would simply fire all their S_2 workers if they could get away with it (assuming $\pi > 0$). The impact of the policy depends on the size of q relative to γ, and the next three sections examine the implications of setting q equal to, less than, and greater than γ, respectively. Subsequently, we will investigate the possibility of some

firms attempting to engage in "skill bumping," i.e., attempting to meet the quota by upgrading unskilled minority workers to skilled positions, and then we will examine the likelihood of reverse discrimination, i.e., lifting the first part of AAP when the quota drives W_s^2 above W_s^1.

Throughout the analysis we will assume that there is universal compliance with the provisions of AAP. This is perhaps the most heroic of all the assumptions of our analysis, for there is usually a strong incentive for the typical firm to get around its provisions. Indeed, it would probably take a very large enforcement staff as well as still retroactive penalties to make it stick.

C. A Quantitative Model

In order to get an idea of the quantitative magnitude of the effect of variations in the policy we shall discuss in the next section, we will employ a numerical model of the impact of the policy on the relative earnings of black males relative to white males.

The production function is C.E.S.,

$$(1) \quad Q = c[\delta S^{\frac{\sigma-1}{\sigma}} + (1-\delta)U^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}$$

so the marginal products of the two types of labor are

$$(2) \quad F_s(k) = c\delta k^{-\frac{1}{\sigma}}[\delta k^{\frac{\sigma-1}{\sigma}} + 1-\delta]^{\frac{1}{\sigma-1}}$$

and

$$(3) \quad F_u(k) = c(1-\delta)[\delta k^{\frac{\sigma-1}{\sigma}} + 1-\delta]^{\frac{1}{\sigma-1}}.$$

Using college graduates versus non-college graduates as the (admittedly somewhat arbitrary) delineator of "skill," we can make some reasonably solid estimates of the relevant parameters of (1). First, a number of estimates of the elasticity of substitution, including separate ones by the authors,[4] place σ at about 1.5. Arbitrarily setting F_u at 100, the value of F_s at a nine per cent rate of return to college is about 150. The value of k for males in 1970 was .1636 (See Table 1). These facts are sufficient to identify

Table 1

Proportions of Males Over Age 24 in Four Skill/ Race Classifications, 1970

	1 (whites)	2 (blacks)	total
S	.1365	.0041	.1406
U	.7734	.0860	.8594
total	.9099	.0901	1.0000

Source: Statistical Abstract of the U.S., 1971. Table 162.

δ at .3097 and c at 196.01. Thus, the equations for the marginal products of the two types of labor become

$$(4) \quad F_s(k) = 60.704\, k^{-2/3}[.3097\, k^{1/3} + .6903]^2$$

and

$$(5) \quad F_u(k) = 135.306[.3097\, k^{1/3} + .6903]^2.$$

The value of γ for the blacks/whites case is determined from Table 1 to be .0300 as compared with the population ratio of $\rho = .0990$.

We will present estimates of the impact of the various versions of AAP on the basis of three alternative assumptions concerning the size of π. These are: $\pi = 30$ (a 20 per cent discrimination coefficient), $\pi = 15$ (a ten per cent discrimination coefficient), and $\pi = 0$ (no labor market discrimination).

III. The Impact of the Program on the Distribution of Income

The effect of AAP will depend on how it is enforced and how in turn firms react to the policy. The first issue concerns whether or not the quota under AAP is set so that the firms have to hire more minority skilled labor than is available in the economy. If the answer to this is in the affirmative, there is then the question of whether firms will fire some of their skilled majority workers (or "bump" them down), place some of their unskilled minority workers in positions with a skilled job title and at a skilled wage rate (bump them up), or engage in reverse wage discrimination in order to meet the quota.

A. The Impact of AAP with $q = \gamma$

The simplest case is that in which every firm in the economy is told it must hire skilled minority workers in proportion to their relative weight in the skilled labor force, i.e., $q = \gamma = S_2/S_1$. We ignore the problems arising from the fact that minority groups (e.g., blacks but not women) are distributed unequally on a geographic basis; AAP would have to be amended to take care of this. First, all firms would have to pay the

same wage to S_1 and S_2 workers, and each firm would have to hire $\gamma/(1+\gamma)$ S_2 workers per skilled worker. Firms with fewer S_2's than the quota would have to attract more in order to maintain their skilled work force. Firms that exceeded the quota, however, would let their surplus S_2's go because they now cost more than the pre-AAP wage W_s^2.

After a great deal of readjustment, the skilled wage would fall to a value W_s' which is strictly between the old wage levels W_s^2 and W_s^1. The reason for this is that the marginal cost of skilled labor to the firm is now $W_s' + \pi\gamma/(1+\gamma)$, and this is set equal to $F_s(k_o)$, where k_o is the pre-AAP and in this case post-AAP skilled/unskilled labor ratio. The old wages were $W_s^1 = F_s(k_o)$ and $W_s^2 = F_s(k_o) - \pi$, so $W_s^2 < W_s' < W_s^1$ so long as $\pi > 0$. If there were no direct labor market discrimination ($\pi = 0$), the policy would cause a lot of shuffling of workers between firms but would not have any ultimate effect on the distribution of income.

The wages paid minority and majority unskilled workers would still be $W_u = F_u(k_o)$, and employers are still receiving their income transfer to compensate for the hiring of the S_2 workers. Thus, the ultimate impact of AAP in the case of $q = \gamma$ is a transfer of income from majority skilled to minority skilled workers. Put differently, AAP in this case forces all skilled workers to share proportionately the burden of discrimination against minority skilled workers.

We now apply the quantitative model set out in II-C when the quota is set equal to the number of black college graduates. The quota is set at $q = .03$, so the new skilled wage is $W_s' = 150 - .0309\pi$. For $\pi = 15$, $W_s' = 149.54$, and for $\pi = 30$, $W_s' = 149.07$. This represents a fall in the income of skilled whites of 0.3 per cent and 0.6 per cent for the respective

values of π. For black skilled workers, however, income rises by 14.54 from 135 when $\pi = 15$, or 10.8 per cent, and by 29.07 from 120 when $\pi = 30$, or 24.2 per cent. For the case of $\pi = 30$, the ratio of average black wages to average white wages increases from .93 to .9523, or, in other terms, the policy results in a closure of 22 per cent of the (unadjusted) black/white earning differential.

B. Impact of AAP with $q < \gamma$

Suppose that the administrators of AAP underestimate the number of minority skilled workers and set the quota below the available supply. (Another reason why q might be set below γ would be political pressure from skilled majority workers who, as we shall see, may benefit from the policy.) In the absence of employer discrimination ($\pi = 0$), the policy would have no effect on wages, but if $\pi > 0$ firms would get rid of surplus (i.e., those not required by the quota) skilled minority workers, for, because of the equal pay provision of AAP, firms can no longer be fully compensated for hiring S_2 workers. We will thus focus solely on the effects of the policy with $\pi > 0$.

There are two major effects on the skilled wage in the case of labor market discrimination. First, as with the case of $q = \gamma$ the marginal cost of hiring skilled labor rises due to the imposition of AAP, and the marginal productivity condition for skilled labor becomes $F_s(k') = W_s' + (q/(1-q))\pi$. This tends, of course, to drive W_s' below F_s. On the other hand, firms will only hire qS_1 of the γS_1 skilled minority workers, and the remainder will be forced to find jobs as unskilled workers. We assume explicitly throughout this section that whenever a skilled worker is forced to work in an unskilled capacity his productivity is identical with that of regular

unskilled workers. This makes $k' < k_o$, and F_s increases accordingly. Another effect results from the fact that since employment of skilled minority workers falls below its pre-AAP level, the total wage bill in the economy increases.

The only result which is immediately apparent from the above is that unskilled workers lose from the above policy, for their wage falls as a result of the influx of $(\gamma - q)S_1$ of the S_2's into their ranks. Some skilled minority workers lose because they have to accept W_u'. The effect on the S_1 workers is also ambiguous; F_s rises but skilled majority workers have to share the cost of discrimination. If, however, $q = 0$ (i.e., no quota is set), it is obvious that the policy is simply a transfer program from all other groups to skilled majority workers.

For a quantitative estimate of the impact of AAP, we will assume that q is set at .015, half the value of γ in our blacks/whites example. This means that instead of .0041 of the male population being skilled black workers only .00205 are. The value of k falls from .1636 to .1608, so F_s increases from 150 to 151.38. F_u, on the other hand, decreases from 100 to 99.77, which is the value of W_u'. With $q = .015$, the new value of the skilled wage level is $W_s' = 151.38 - .04148$. For $\pi = 15$ $W_s' = 151.16$, and for $\pi = 30$ $W_s' = 150.94$. With $\pi \doteq 15$, half the skilled minority workers move from a wage of 135 to 151.16, but the other half move from 135 to 99.77 as unskilled workers, so their average is 125.47, or a <u>decrease</u> of 7.1 per cent. For $\pi = 30$, however, the average is 125.36 as compared to 120 in pre-AAP times, and this represents an increase of 4.5 per cent. Staying with $\pi = 30$ (the twenty per cent discrimination coefficient), the ratio of average black wages to average white wages exhibits a slight increase from

.9387 to .9399, or a reduction in the gap between blacks and whites of only about two per cent. If $\pi = 15$, the relative income of blacks in the aggregate falls.

C. Impact of AAP with $q > \gamma$

The most interesting case arises when the quota is set above the available supply of skilled minority labor. Then firms with fewer S_s's than are required by the quota must fire some of their S_1's. At the prevailing wage level, which is now W_s^1 because of the equal pay provision, these firms would demand more skilled minority workers than they currently hire and would raise their skilled wage accordingly. When all adjustments are completed, the value of the skilled/unskilled labor ratio has fallen from k_o to k', because only S_2/q skilled majority workers can be employed in a skilled capacity because of the quota provision. Thus, $(1-\gamma/q)S_1$ workers transfer to unskilled positions.

As with the case of $q < \gamma$, the marginal productivity condition for skilled labor is $F_s(k') = W_s' + (q/1+q)\pi$. Now, however, we can conclude unambiguously that skilled minority workers gain by the policy, for the burden of discrimination is shared with their majority counterparts and the marginal product of skilled labor has increased. As with the case of $q < \gamma$, all unskilled workers lose by the policy, for $F_u(k') < F_u(k_o)$. The effect of AAP on the position of skilled majority workers is unclear. If the value of π is not very great (and the value of σ small), $W_s' > W_s^1$, but some S_1's are receiving the unskilled wage rate.[5]

To obtain an idea of the quantitative effects of AAP in this case, we will see what happens when q is set at .045 (which is as high above γ

as .015 was below it). In this case, one-third of skilled majority workers must transfer to unskilled jobs, and the value of k falls from .1636 to .1039. This implies that $F_s(k')$ increases from 150 to 191.91, and $F_u(k')$, and hence W_u, falls from 100 to 94.54. The skilled wage is 191.91 when $\pi = 0$, 191.26 when $\pi = 15$, and 190.69 when $\pi = 30$. This obviously represents a huge increase in the earnings of minority skilled workers -- ranging from 27.9 per cent for $\pi = 0$ to 58.9 per cent when $\pi = 30$. Despite the fact that a third of skilled majority workers are forced by the quota to take unskilled jobs, their average income actually increases as a result of AAP, from 150 to 159.45 with $\pi = 0$, 159.02 with $\pi = 15$, and 158.64 with $\pi = 30$.

The nature of the redistribution of income due to AAP is seen most clearly in Table 2. Notice first that the aggregate labor incomes of both blacks and whites falls. For $\pi = 0$, 15, and 30 the average income reduction for blacks is 3.2, 2.5, and 1.8 per cent, respectively, and for whites it is 3.0, 3.1, and 3.1 per cent respectively. Thus, for low values of the discrimination coefficient, blacks in the aggregate lose ground due to AAP, even if $q < \gamma$, for they already are overrepresented in the ranks of the unskilled. For high values of the discrimination coefficient, they gain slightly. For $\pi = 30$, the ratio of black to white incomes rises from .9387 in the pre-AAP period to .9510 after its imposition, or a reduction of 20 per cent of the black/white income gap.

D. Implications of Skill Bumping

In the preceding example a third of the skilled majority work force (and only slightly less than a third of the entire skilled work force) was relegated to unskilled jobs because of the quota restriction. Given

Table 2

Incomes and Wage Bills of Four Race/Skill Categories
Before and After Imposition of Quota ($q = .045$)

			1 whites			2 blacks	
		π	inc.	wage bill	π	inc.	wage bill
S	pre	0	150	20.48	0	150	.62
		15	150	20.48	15	135	.55
		30	150	20.48	30	120	.49
	post	0	159.45	21.76	0	191.91	.787
		15	159.02	21.71	15	191.26	.784
		30	158.64	21.65	30	190.69	.782
U	pre	0-30	100	77.34	0-30	100	8.59
	post	0-30	94.54	73.12	0-30	94.54	8.13

the two provisions of the law, however, there is more to the story. Suppose that a crafty entrepreneur decided to comply with the provisions of the law by offering some of the underutilized S_1 workers a wage of W_s'' and meeting the quota by calling some of its unskilled minority workers "skilled" (and paying them the skilled wage W_s''). As long as $W_s'' > W_u$, this arrangement is beneficial to both the S_1 and U_2 workers involved.

We will assume that the firm is able to employ the U_2's it "bumps" to a skilled wage in an in fact unskilled status and that, if the firm has a taste for discrimination, it still receives disutility for each of the U_2's so treated. The marginal cost of skilled labor for the firms that meet the quota by hiring both S_1 and S_2 workers is $W_s' + (q/(1+q))\pi$. The marginal cost of skilled labor for those firms that engage in skill bumping is $(1+q)W_s'' + q\pi - qW_u'$. If the law permits this type of behavior (and there is nothing in the two provisions that makes it illegal), there would be two sets of marginal conditions for skilled workers, i.e.,

$$(6) \quad F_s(k_o) = W_s' + \pi\left(\frac{q}{1+q}\right) = W_s''(1+q) + \pi q - W_u'q$$

Note that all skilled labor would be employed in the skilled occupation in this case, so $k = k_o$. Since $W_u' = F_u(k_o)$, we see that

$$(7) \quad W_s' = F_s(k_o) - \pi\left(\frac{q}{1+q}\right)$$

and

$$(8) \quad W_s'' = F_s(k_o)\frac{1}{1+q} + F_u(k_o)\frac{q}{1+q} - \pi\left(\frac{q}{1+q}\right)$$

In order for bumping to be attractive to skilled minorities who cannot receive W_s' because of the quota restriction, it must be true that $W_s'' > W_u'$. This is clearly satisfied so long as $F_s(k_o) - F_u(k_o) > \pi$, but this had to be so, for $W_s^2 > W_u$ in the pre-AAP period. The same condition assures that $W_s' > W_s''$.

The qualitative effects of this policy on the distribution of income are quite straightforward. The S_2 workers clearly gain, although not as much as they would gain if $q = \gamma$ or if skill bumping were made illegal. Unskilled majority workers are unaffected by AAP, but the average earnings of unskilled minority workers increase, for a fraction of them receive $W_s'' > W_u'$. The big losers are the skilled majority workers; those who are lucky receive $W_s' < W_s^1$ and those who are unlucky receive $W_s'' < W_s'$. Thus, the existence of skill bumping drastically shifts the burden of AAP.

We will present numerical estimates for the skill bumping case with $q = .045$. Since there is no "underemployment" of the S_1's, $k = k_c$ and the marginal products of the two skill groups are the same as in the pre-AAP period. W_s' is 150, 149.35, and 148.71 as π is 0, 15, and 30. The wages of the S_2's increase by 0, 10.6, and 23.9 per cent as π is 0, 15, and 30. The value of W_s'' is 147.81, 147.16, and 146.52 for $\pi = 0$, 15, and 30, respectively, and at $q = .045$, a third of the skilled majority workers receive this lower wage. Thus, the average earnings of the S_1's is 149.27 in the absence of discrimination, 148.62 when $\pi = 15$, and 147.98 when $\pi = 30$. With $q = .045$, only 2.4 per cent of unskilled minority workers get bumped to the W_s'' wage, so the average earnings of the U_2's are increased from 100 in the pre-AAP period to 101.15, 101.13, and 101.12 for the respective values of π. Finally, with $\pi = 30$ the average earnings of all black workers relative to all white workers is .9635, which, since the pre-AAP value was .9387, the AAP policy with skill bumping and $q = .045$ closes 40 per cent of the earnings gap between black and white males.

If q were set equal to .099, the black/white population ratio, the effects of AAP would, of course, be more profound. W_s' is now 150,

148.65, and 147.30 as π is 0, 15, and 30, and value of W_s'' is 145.50, 144.15, and 142.80 for the three cases. Given such a large quota relative to the number of black skilled workers, only .303 of the S_1's can receive W_s's the remaining .697 receive W_s''. This means that the average income of the S_1's is 146.86, 145.51, and 144.16 for the three values of π. In order to meet the .099 quota, firms have to bump 11.0 per cent of unskilled black workers to the W_s'' wage, and this causes the average income of the U_2's to rise to 105.01, 104.86, and 104.71 for π = 0, 15, and 30. For the situation in which π = 30, the average incomes of blacks relative to whites rises from .9387 in the pre-AAP period to 1.0052, i.e., AAP eliminates the black/white income gap.

E. Reverse Wage Discrimination

The equal pay provision of AAP is, of course, intended to put a stop to $W_s^2 < W_s^1$. It would also be against the law for firms to reverse this inequality, but in this section we examine the implications of AAP with $q > \gamma$ when the first provision as <u>enforced</u> only requires that firms pay skilled minority workers at least as much as they pay skilled majority workers.

The reason that the possibility of reverse wage discrimination comes to mind is that under the equilibrium with skill bumping in a segment of the labor market some skilled majority workers receive W_s' while others receive the lower rate W_s''. Consider another crafty entrepreneur who hires both S_1 and S_2 workers at a wage W_s'. Why, he asks, should he pay his skilled majority workers W_s' when the same type of labor receives W_s'' across the street and the AAP administrators are quite unlikely to be offended

his lowering their wages to W_s''? This lowers the costs of production and is emulated by other firms, but this increases the demand for skilled labor and thus the value of W_s'. In particular, the marginal cost of skilled labor for a firm hiring both S_1 and S_2 workers is now $W_s'(1/(1+q)) + W_s''(q/(1+q)) + \pi(q/(1+q))$ instead of $W_s' + (q/(1+q))$ when the equal pay provision was enforced both ways. Since $q > \gamma$, there will still be some firms with marginal costs of $W_s''(1+q) + \pi q - W_u q$. The marginal productivity conditions along the lines of (6) imply that the wage of skilled majority workers is given by (8), but the wage of skilled minority workers is given by

$$(9) \quad W_s' = F_s(k_o)\frac{2+q}{1+q} - F_u(k_o)\frac{1}{1+q} - \pi\left(\frac{q}{1+q}\right) .$$

Notice that the difference between W_s' and W_s'' is $F_s(k_o) - F_u(k_o)$, which is the difference in the value added to a firm between meeting the quota by hiring a skilled worker and meeting it by hiring an unskilled worker. Notice also that W_s' <u>falls</u> as the quota is increased.

Quantitatively the impact of this modification is quite similar to the skill bumping case discussed in the preceding section. For $q = .045$ the major differences are that the skilled wage for blacks rises to 200, 199.35, and 198.71 for values of π of 0, 15, and 30, respectively, and the average skilled wage for whites falls to W" as reported in the preceding case. Contrasting the reverse discrimination case with the skill bumping with equal pay case, the result is simply an income transfer from skilled whites to skilled blacks. Given reverse discrimination and $\pi = 30$, the average earnings of blacks relative to whites rises to .9867 from the pre-AAP ratio of .9387, which implies that 78 per cent of the gap is eliminated. We will not go into all the details of the effect of AAP with reverse discrimination

with q = .099, but the black/white average earnings ratio with π = 30 rises to 1.0242 as a result of AAP. We imagine, however, that before that much adjustment took place the policy would be abolished (probably by a Supreme Court decision).

F. Behavioral Predictions

It is important to point out that the probable impact of the policy depends quite crucially on whether or not firms find it possible to skill bump as well as whether or not they can engage in reverse discrimination. This is shown quite clearly in Table 3 in which the average wages for the four race/skill categories under AAP with a quota of .045 with π assumed to be 0. Without skill bumping the program results in a transfer from unskilled workers to skilled workers (especially minority ones), and the increase in the ratio of black to white earnings is quite modest. Indeed, the program could hardly be judged worth the resultant three per cent decline in GNP. When skill bumping takes place, AAP causes a small redistribution from skilled majority to unskilled minority workers, and the increase in the average earnings of blacks is greater than without bumping. The reverse discrimination case results in a further redistribution from the S_1's to the S_2's and there is a very substantial increase in the relative earnings of blacks.

These are very different predictions about the effect of the program, and it is thus in order to look more closely into the conditions under which skill bumping will take place. Recall in Part C of this section we maintained that it was in the interest of some firms to meet the quota

Table 3

Summary of AAP on Distribution of Earnings with $q = .045$ and $\pi = 0$

Case	S_1	S_2	U_1	U_2	All Workers	All 1 Workers	All 2 Workers	$\frac{Y_2}{Y_1}$
pre-AAP	150	150	100	100	107.0	107.5	102.3	.952
No Bumping	159.5	191.9	94.5	94.5	103.8	104.3	99.9	.958
Bumping	149.3	150	101.2	100	107.0	107.4	103.4	.962
Reverse Discrimination	147.8	200	101.2	100	107.0	107.2	105.7	.986

by hiring underemployed S_1's to perform skilled functions and then labeling some of their U_2's as skilled but continuing to use them in an unskilled capacity. This, of course, implicitly assumes that the U_2's who are bumped up do not protest the fact that their new job titles (and higher salaries) are not accompanied by a "meaningful" job content. Suppose instead that the U_2's who are bumped to skilled status have a zero productivity in their new jobs. This would mean that the marginal cost of skilled labor for firms that skill bump would be $(1+q)W_s'' + q\pi$. Thus, the equilibrium value of W_s'' would be $F_s(1+q) - \pi(q/(1+q))$. Bumping is feasible if W_s'' exceeds W_u, and this requires that $F_s > F_u(1+q) + q\pi$, but, unlike the case discussed in Part D of this section, this is not necessarily satisfied. If q is fairly large (as it would be, for example, with the case of women), firms would find it unprofitable to skill bump. Then the effects of the program would be those we obtained under the no skill bumping case. Accordingly,

it would be in the interests of unskilled workers to encourage bumping. It would probably not be wise for skilled majority workers to do so (it depends on the values of the parameters -- especially σ and π). For the case of a numerically small minority (like blacks in the U.S. or Greenlanders in Denmark but unlike, for example, blacks in South Africa, Catholics in Northern Ireland, French-speaking residents of Quebec), q will be fairly small, and the above inequality will be satisfied.[6] For the numerical example with $\pi = 30$ and $q = .045$, bumping will occur because $150 > 104.5 + 1.35 = 105.85$ by a large margin.

It is thus likely that for the cases of blacks and other minorities in the U.S. the provisions of AAP would be met by firms bumping unskilled target groups to skilled positions rather than by the wholesale demotion of skilled majority workers. The other behavioral question concerns the extent to which firms will engage in reverse wage discrimination. As we showed in part E of this section, it is clearly in their <u>interests</u> to do so -- there is no reason for firms to pay skilled whites more than their market wage just because the market wage of skilled blacks is higher. The extent to which there will be reverse discrimination will depend on the degree to which the AAP authorities enforce the equal pay provision both ways. Although reverse wage discrimination would probably be ruled illegal by the courts, firms could invent inflated job titles for skilled minority workers, and it would be very expensive for an individual S_1 to bring suit on the grounds of a form of discrimination that is probably sufficiently subtle to fool most judges and lawyers anyway. Given the reasonable expectation that the AAP personnel would be less concerned with reverse wage discrimination than with eliminating both discrimination against minorities and compliance with the quota, it therefore seems likely that reverse wage discrimination would result from AAP.[7]

IV. Heterogeneous Labor

To this point we have considered the impact of AAP in the context of a two-skill model. This permitted us to analyze a number of aspects of the impact of the program, but it masks a very important result which pops out of a more conventional human capital theoretic approach.

Assume that prior to the imposition of AAP the wage of majority workers was equal to the wage for "raw" labor (W_o) plus the market value of their acquired skills (K),[8] or

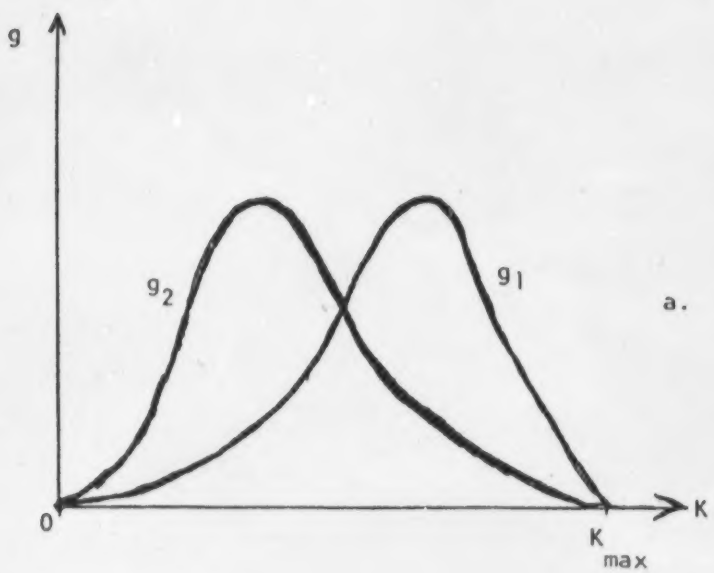
$$(10) \quad W_1 = W_o + K.$$

To retain labor discrimination in the model, we will assume that employer discrimination results in a reduction of the return on the human capital of minority workers by a certain fraction, say $0 \leq \Delta < 1$. Thus,

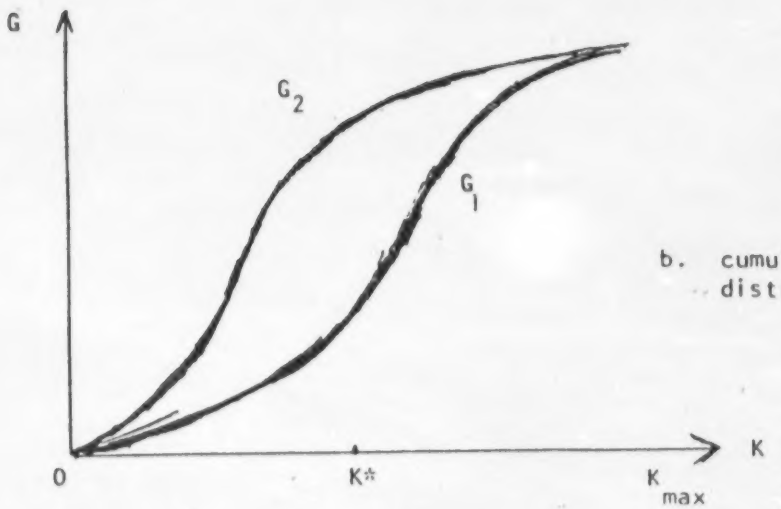
$$(11) \quad W_2 = W_o + (1-)K.$$

The distribution of K is given in the short run with frequency distributions $g_1(K)$ and $g_2(K)$. We hypothesize that the mean skill level of majority workers, $\bar{K}_1 = \int_0^{K_{max}} (K)\,dK$, exceeds $\bar{K}_2$. Further, the distributions g_1 and g_2 are well behaved in the sense that $G_2(K') > G_1(K')$, for all $K' < K_{max}$, where $G_i = \int_0^{K_{max}} g_i(K)\,dK$ is the cumulative frequency distribution of skills for the i^{th} group. A set of marginal and cumulative distributions with plausible shapes for this problem are shown in Figure 1.

AAP calls for equal pay for identical job assignment and that each job must be filled by minority and majority workers according to their relative size in the population. This means that the ρ most skilled minority workers will work with the most skilled majority worker, the second ρ most



a. marginal distributions



b. cumulative distributions

Figure 1

skilled minority workers will work with the second most skilled majority worker, and so on. Because of the equal pay provision, this means that the wage for the typical job will be

$$(12) \quad W'' = W_o + \delta K_2 + (1-\delta)K_1 - \delta\Delta K_2,$$

where $\delta = \rho/(1+\rho)$ and K_2 and K_1 are the skill levels of each group associated with the job. The association between skill levels is determined by the cumulative frequency distributions, that is

$$(13) \quad G_1(K_1) - G_2(K_2) = 0.$$

It thus follows that $dK_1/dK_2 = g_2/g_1$ and $dK_2/dK_1 = g_1/g_2$.

It necessarily follows that since AAP eliminates wage dispersion within job classifications and forces the distribution of job classifications to be identical for both majority and minority workers, average earnings for the two groups will be the same. The gain in earnings by minority workers is

$$(14) \quad W' - W_2 = (1-\delta)(K_1-K_2) + (1-\delta)\Delta K_2.$$

Differentiating this with respect to K_2, we obtain

$$(15) \quad \frac{d(W'-W_2)}{dK_2} = (1-\delta)\left[\frac{g_2}{g_1} - 1 + \Delta\right].$$

The second derivative is

$$(16) \quad \frac{d^2(W'-W_2)}{dK_2} = (1-\delta)\left[\frac{1}{f}\frac{dg_2}{dK_2} - \frac{g_2}{g^3}\frac{dg_1}{dK_1}\right].$$

When $\Delta = 0$ the earnings gain is greatest for minority workers with skill equal to K_* (for $dg_2/dK_2 < 0$ and $dg_1/dK_1 > 0$ around $K = K_*$). This is <u>not</u> accomplished at $K_2 = K_*$ in Figure 1, for at this point $K_1 > K_2$ so $f_1 > f_2$; rather it is accomplished for K_2 somewhat lower and K_1 somewhat higher than K_*. The higher the value of the discrimination coefficient Δ, the higher the value of K_2 at which the gain for minority workers is greatest. The

loss to majority workers due to the policy is given by

$$(17) \quad W_1 - W' = \delta(K_1 - K_2) + \delta\Delta K_2,$$

and this loss is greatest under the same conditions as the gain for minority workers is greatest.

The preceding results have a straightforward intuitive explanation. Under AAP the most skilled and the least skilled minority workers are matched with majority workers of more or less equal skill, so they do not gain very much by the policy. Minority workers in the middle of the skill distribution, however, are bumped up to work with relatively highly skilled majority workers, and they benefit enormously. To put the result in more concrete terms, a black male neurosurgeon has gone about as far as he can; a black foreman, on the other hand, would stand a good chance under AAP of becoming a plant manager; the black ditchdigger, who is at the bottom of the K_2 distribution, is not going anywhere. The white plastic surgeon is not much hurt by AAP -- the AAP administrators are <u>not</u> about to flood the neurosurgeon market with fresh black B.A.'s; the white foreman, however, would likely be passed up in the search for plant manager; and the white ditchdigger will continue to work with blacks as he has been doing for some time.

The most interesting point about the heterogeneous labor case concerns the effect of AAP on the rate of return to acquiring more skill. The rate of return to acquiring another unit of human capital is (ignoring out-of-pocket costs of investment) given by

$$(18) \quad R_i = \frac{dW_i}{dK_i}\frac{1}{W_i} = \frac{dW_i/dK_i}{W_i} .$$

In the pre-AAP period this was

$$(19) \quad R_1^o = \frac{1}{W_o+K_1}$$

for majority labor and

$$(20) \quad R_2^o = \frac{1-\Delta}{W_o+(1-\Delta)K_2}$$

for minority labor. Under AAP, these rates of return become

$$(21) \quad R_1' = \frac{(1-\delta)+\delta(1-\Delta)f_2/f_1}{W_o+K_2+(1-\delta)K_1-K_2}.$$

and

$$(22) \quad R_2' = \frac{\delta(1-\Delta)+(1-\delta)f_2/f_1}{W_o+K_2+(1-\delta)K_1-K_2}.$$

First, we ask what happens to the rate of return to acquiring human capital as a result of AAP. It can be shown that $R_2' \gtrless R_2^o$ as

$$(23) \quad \frac{f_2}{f_1} \gtrless \frac{(1-\Delta)[W_o+K_1]}{[W_o+(1-\Delta)K_2]}.$$

Since f_2/f_1 is large for low K and small for high K, this means that <u>the incentive for minorities to get to the high side of the skill distribution falls under AAP</u>. Instead, the incentive structure is such that it pays minorities to obtain "just enough" human capital to get bumped to a high position.[9] This means that the minority distribution of K would tend to peak in the middle, and, holding g(K) constant, this would exacerbate the problem.

Second, what happens to the rate of return to skill acquisition for majority workers? It turns out that the condition for $R_1' > R_1^o$ is <u>just the opposite</u> of the condition for $R_2' > R_2^o$ given by (23). Thus, the incentives to acquire more skill are increased for the majority population and lowered

for the minority population as a result of AAP. Accordingly, if the policy of requiring identical distributions of job classification were maintained, the skill distributions would grow further apart rather than coming together.

These two results suggest that skill distributions between majority and minority populations will have a tendency to diverge, and this would exacerbate the problems that make AAP a potentially desirable policy in the first place. This conclusion must, however, be qualified. To the extent that family income is an important determinant of the educational attainment of children, the policy will simultaneously lead to a convergence of skill distributions, for minority families -- especially those in the middle of the skill distribution -- will gain from being bumped to higher positions as well as from the elimination of labor market discrimination. In other words, AAP will reduce incentives for minorities to acquire skills (they won't need as much skill to "make it"), but it will increase their financial ability to acquire skill. Which of these effects is quantitatively the more important is, given the state of the art, a matter of speculation at this time. For blacks and other ethnic minorities in the U.S., the income effect might be very important. For white women, on the other hand, the income effect would not have much impact on decisions concerning educational attainment, for AAP would not have much effect on their parents' income.

V. Concluding Remarks

In this paper we have examined the implications of an economy-wide affirmative action program under a number of alternative specifications of the way firms will react and of the legal context. It is interesting to

contrast our results with those of Flanagan.[10] He attempts to estimate the potential impact of contract compliance programs by calculating the reduction in the racial differential due to the elimination of various sources of the differential. Interestingly, his empirical estimates of potential impact for the "full coverage" case (his Table 4) are in line with some of our results in Section III with $\pi = 30$.

The point of our analysis as distinct from Flanagan's, however, is that a rigidly enforced system of quotas may have important secondary effects. First, if skill bumping is not legally permitted, there will be fairly serious allocational consequences of AAP, for a significant fraction of skilled majority workers will not be fully utilized if q is set above γ. Second, if reverse discrimination is legally and institutionally permissible, AAP may result in a reversal of income differentials between majority and minority workers -- even if there is a wide disparity in initial skill distributions. Third, as we point out in the final section of the paper, it is likely that AAP would lower the incentives for minority workers to accumulate high levels of skill but raise the incentives for majority workers. To the extent that this tendency is not offset by income effects, AAP would thus tend to exacerbate part of the problem of income inequality. Over time, then, more and more resources would have to be allocated to the program to keep it going.

Footnotes:

1. See Finis Welch, "Employment Quotas for Minorities," Journal of Political Economy, forthcoming.

2. This is the simplest version of the model of "employer discrimination" set forth in Gary S. Becker, The Economics of Discrimination, University of Chicago Press, 1956.

3. Because of the assumption of linear homogeneity of the production function $F(S,U) = U\phi(S/U)$. The marginal product of skilled labor is $F_s = \phi'(k)$, and the elasticity of Q w.r.t. S is $\eta = \phi'k/\phi$. The elasticity of substitution between the two types of labor is defined as $\sigma = -\phi(\phi-\phi'k)/k\phi\phi''$. Now the derivative of F_s w.r.t. k is $dF_s/dk = \phi'' = -\phi'(\phi-\phi'k)/k\phi\sigma$, and it quickly follows that $d(\log F_s)/d(\log k) = -(1-\eta)/\sigma$. The second result above is derived analogously.

4. See Finis Welch, "Education in Production," Journal of Political Economy, January/February 1970 and George E. Johnson, "The Demand for Labor by Educational Category," Southern Economic Journal, October 1970.

5. More formally, if $\pi = 0$ the average earnings of skilled majority workers is $y_s' = F_s(k')\gamma/q + F_u(k')(1-\gamma/q)$. The effective skilled/unskilled labor ratio is $k' = k(q-(q-\gamma)s)/(q+(q-\gamma)ks)$, where $s = s_1/s$. The effect on y of an increase in the quota in the neighborhood of $q = \gamma$ is then

$$dy_s' = \{F_s \frac{1-\eta}{\sigma} \frac{s(1+k)}{\gamma} - (F_s - F_u)\frac{1}{\gamma}\}\, dq,$$

which is of ambiguous sign. For the case of an infinite elasticity of substitution, an increase in the quota decreases y_s'; for a low value of σ an increase in the quota increases y_s.

6. We have, of course, made the strong assumption that the U_2's are completely unproductive in their new assignments. Welch, op. cit., assumes that they retain a certain fraction $\theta(0 \leq \theta \leq 1)$ of their former productivity as unskilled workers.

7. This conclusion is consistent with the finding by Freeman that as of 1973 black academics received 7-8 per cent more than white academics with similar qualifications. See R. B. Freeman, "A Premium for Black Academicians in the 'New Market'?," mimeo, Harvard University, 1974.

8. This implicitly assumes that the intra-factor elasticity of substitution is infinite, which means that the return to the k^{th} unit of human capital is independent of the distribution of human capital across the population.

9. This is consistent with the simulation results for the two skill case with skill bumping set out in Section II-D. When π was low in the case of $q = \rho$, the earnings of black skilled workers relative to black unskilled workers actually fell.

10. See Robert J. Flanagan, "The Influence of Government Antidiscrimination Programs: Actual vs. Potential Impact," DOL-ASPER, TAP No. 27, February 1975.